MiniModule™/SVG-II

Technical Manual

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Revision History

Revision	Reason for Change	Date
1	First Release	3/95
A	Production Release	7/95

PREFACE

This manual explains how to install a MiniModule™/SVG-II into a system based on an Ampro CPU module. This manual presumes that the reader has some knowledge of PC-based computer systems and, in particular, the PC VGA display architecture. This manual explains how to configure and install the controller, and how to set the modes for all the various resolutions, for text and graphics. It also provides information about the support software and drivers included with the MiniModule/SVG-II Development Kit.

Specifically, this manual contains three chapters, organized as follows:

- **Chapter 1 Introduction.** Provides an introduction to the features and specifications of the MiniModule/SVG-II. It provides information on which monitors are supported, and what resolutions are supported.

- **Chapter 2 Configuration and Installation.** Describes how to set jumpers, connect a monitor, and install the module in a system.

- **Chapter 3 Operation.** Shows how to install the support software, change video modes, and describes ways to program the controller using third-party software and BIOS calls. Provides a list of references to other vendor's software. Describes power management features. Outlines the functions of the feature connector.

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CHAPTER 1

INTRODUCTION

1.1 GENERAL DESCRIPTION

The Ampro MiniModule/SVG-II expansion module is a compact, high-resolution graphics display controller, offering software selectable multimode operation. It is implemented in low power CMOS logic, and requires less than 2 watts of power. The module conforms to the PC/104™ Version 2.1 standard and attaches directly to any Ampro product having a PC/104-compatible header for MiniModule addition.

1.2 FEATURES

- Resolution up to 1024 x 768 with 256 colors, interlaced or non-interlaced.
- Text Density up to 132 columns x 43 rows
- Hardware and software compatible with the popular VGA video standards
- Software switching between modes
- Compatible with analog fixed frequency and multifrequency monitors
- Provides a feature connector for external video sources
- Conforms to the popular PC/104 Version 2.1 standard for embedded computers.
- 5 volt-only operation and low power consumption (<2 watts)
- Comprehensive power management features—Energy Star compliant

1.3 SOFTWARE COMPATIBILITY

The MiniModule/SVG-II is both register and BIOS-level compatible with all popular PC video standards. It supports the four most popular PC-compatible video formats, (VGA, EGA, CGA, and MDA), and also provides even higher Super VGA resolutions conforming to the VESA video display standard.

Specifically, the following extended-resolution Super VGA modes are available:

- 680 x 480 with up to 256 colors
- 800 x 600 with up to 256 colors
- 1024 x 768 with up to 256 colors, interlaced or non-interlaced
- Up to 132 columns x 43 rows text density

Software support for these Super VGA modes is widely available from a variety of sources, including C and other high-level language graphics libraries. A number of software drivers supporting the Super VGA modes is provided on the utility diskette that comes with the MiniModule/SVG-II Development Kit.

1.4 OUTPUT FLEXIBILITY

The MiniModule/SVG-II easily interfaces to standard VGA monitors. It supports various analog multifrequency monitors such as Sony MultiScan, NEC MultiSync, Packard Bell UniSync, Amdek

Smart Scan, Nanao FlexScan, and Mitsubishi Diamond Scan, and supports fixed frequency analog monitors such as the IBM 85XX family.

The MiniModule/SVG-II controller provides two display interface headers. One is for connecting a standard analog CRT display. The other is a PC-standard feature connector. Ampro provides a transition cable (DB15) with the MiniModule/SVG-II Development Kit to transfer signals to analog monitors.

1.5 POWER MANAGEMENT FEATURE

The MiniModule/SVG-II features comprehensive power management functions that support low-power operation. To take advantage of the features built into the MiniModule/SVG-II, the OEM can call video-BIOS extensions or set bits in registers in the video controller chip to place the controller and the attached display monitor in low-power modes. To take full advantage of the power saving features, the monitor must, of course, comply with the DPMS (Display Power Management Signaling) standard.

1.6 OPERATING MODES AND RAM REQUIREMENTS

The MiniModule/SVG-II controller supports many operating modes, offering a wide variety of resolution choices. The standard module comes with 512K bytes of video memory (DRAM), supporting all standard VGA compatible modes and a useful set of Super VGA modes. The module is also offered with 1 megabyte of video memory, useful when additional color support in high resolution modes are required.

Table 1-1 lists the characteristics of each text mode supported by the MiniModule/SVG-II, and Table 1-2 lists the characteristics for each graphics mode. Both tables show the amount of DRAM needed to support each mode. For the text modes, the table lists the number of rows and columns of text characters that can be displayed, and the cell size of the character. The table also tells you the number of colors that can be displayed in that mode. For the graphics modes, the table shows the total screen resolution in pixels and the number of colors that can be displayed simultaneously. Table 1-3 provides additional data useful in selecting monitors for each of the supported text and graphics modes, including horizontal and vertical frequency, buffer starting address, and clock rates.

As shown in Tables 1-1 and 1-2, with 512 KBytes of DRAM, the MiniModule/SVG-II controller supports extended text modes and graphics resolutions up to 1024 x 768 with 16 colors. With the full 1 megabyte of DRAM, resolutions up to 1024 x 768 with 256 colors are supported.

MODE	VESA MODE	PC STANDARD	ROWS/ COLUMNS	RESOLUTION	CELL SIZE	COLORS/ PALETTE	DRAM
0	-	CGA	40 x 25	320 x 200	8 x 8	16/256	256K
0	-	EGA	40 x 25	320 x 350	8 x 14	16/256	256K
0	-	VGA	40 x 25	360 x 400	9 x 16	16/256	256K
1	-	CGA	40 x 25	320 x 200	8 x 8	16/256	256K
1	-	EGA	40 x 25	320 x 350	8 x 14	16/256	256K
1	-	VGA	40 x 25	360 x 400	9 x 16	16/256	256K
2	-	CGA	80 x 25	640 x 200	8 x 8	16/256	256K
2	-	EGA	80 x 25	640 x 350	8 x 14	16/256	256K
2	-	VGA	80 x 25	720 x 400	9 x 16	16/256	256K
3	-	CGA	80 x 25	640 x 200	8 x 8	16/256	256K
3	-	EGA	80 x 25	640 x 350	8 x 14	16/256	256K
3	-	VGA	80 x 25	720 x 400	9 x 16	16/256	256K
7	-	MDA	80 x 25	720 x 350	9 x 14	mono	256K
7	-	VGA	80 x 25	720 x 400	9 x 16	mono	256K
14	-	Super VGA	132 x 25	1056 x 400	8 x 16	16/256K	512K
54	10A	Super VGA	132 x 43	1056 x 350	8 x 8	16/256K	512K
55	109	Super VGA	132 x 25	1056 x 350	8 x 14	16/256K	512K

NOTE: The MiniModule/SVG-II comes with a minimum of 512K DRAM

Table 1-1 Display Characteristics of Text Modes

MODE	VESA MODE	PC VIDEO STANDARD	RESOLUTION	COLORS/ PALETTE	DRAM
4		CGA	320 x 200	4/256	256K
5		CGA	320 x 200	4/256	256K
6		CGA	640 x 200	2/256	256K
D		EGA	320 x 200	16/256	256K
E		EGA	640 x 200	16/256	256K
F		EGA	640 x 350	Mono	256K
10		EGA	640 x 350	16/256	256K
11		VGA	640 x 480	2/256	256K
12		VGA	640 x 480	16/256	256K
13		VGA	320 x 200	256/256	256K
58/6A	102	Super VGA	800 x 600	16/256K	256K
5C	103	Super VGA	800 x 600	256/256K	512K
5D	104	Super VGA	1024 x 768	16/256K	512K
5E	100	Super VGA	640 x 400	256/256K	512K
5F	101	Super VGA	640 x 480	256/256K	512K
60	105	Super VGA	1024 x 768	256/256K	1 M
NOTE: The MiniModule/SVG-II comes with a minimum of 512K DRAM					

Table 1-2 Display Characteristics of Graphics Modes

Mode	Horizontal (KHz)	Vertical (Hz)
0, 1, 2, 3, 4, 5, 6, 7, 0D, 0E, 0F, 10, 13, 14, 54, 55, 5E	31.5	70
11, 12, 5F	31.5, 37.9	60, 72
58, 6A, 5C	35.2, 37.8, 48.1, 46.9	56, 60, 72, 75
5D, 60	35.5, 48.3, 56, 58, 60	87, 60, 70, 72, 75

Table 1-3 Mode Timing Chart

Display Resolution	Horizontal (KHz)	Vertical (Hz)	Monitor type	CLMODE Monitor Type*
640 x 480	31.5	60	IBM 8512 IBM 8513 IBM 8503	0
640 x 480 1024 x 768	31.5 35.5	60 43.5 (i)	IBM 8514 IBM 8515	1
640 x 480 800 x 600	31.5 35.2	60 56	NEC 2A	2
640 x 480 800 x 600 1024 x 768	31.5 35.2 35.5	60 56 43.5 (i)	NEC II	3
640 x 480 800 x 600 1024 x 768	31.5 37.8 37.8	60 60 43.5 (i)	NEC 3D	4
640 x 480 800 x 600 1024 x 768	31.5 48.0 48.0	60 72 60	Sony CPD-1304 NEC 3FGX Nanao 9065S	5
640 x 480 800 x 600 1024 x 768	31.5 48.0 56.0	60 72 70	NEC 4D NEC 4FG Nanao T240i	6
640 x 480 800 x 600 1024 x 768	31.5 48.0 58.3	60 72 72	NEC 5D NEC 5FG, 6FG Nanao T560i	7

Table 1-4 Timing Parameters of Common Displays

* CLMODE Monitor Type is explained in Chapter 3, "Using the Ampro-Supplied Utility, CLMODE.EXE."

1.7 SPECIFICATIONS

The following sections list the specifications of the MiniModule/SVG-II.

1.7.1 Memory

- Onboard RAM 512K bytes, 1 megabyte
- Display address A0000h to BFFFFh
- ROM-BIOS address C0000h to C7FFFh

1.7.2 I/O Address Space

- 03B4h to 03DAh, 46E8h

1.7.3 Interrupt Option

- IRQ2 (normally not used)

1.7.4 Video Characteristics

- Bandwidth — 25 MHz to 78.7 MHz
- Horizontal Scan Rate — 31.5 KHz to 48.3 KHz
- Vertical Scan Rate — 56 Hz to 75 Hz (87 Hz interlaced)

1.7.5 Physical

- Power consumption — 1.7 watts, worst case (Windows white screen)
1.0 watts, typical.
0.6 watts in Suspend Mode.
0.5 watts in Off Mode
- Voltage — +5VDC ±5%
- Size — 3.6 x 3.8 x 0.6 inches (90 x 96 x 15 mm)
- Operating Environment
  - Temperature — 0-70° C
  - Humidity — 5-95% (non-condensing)
- Storage temperature — -55° to +85° C
- Weight — 2.2 oz. (62.4 gms)

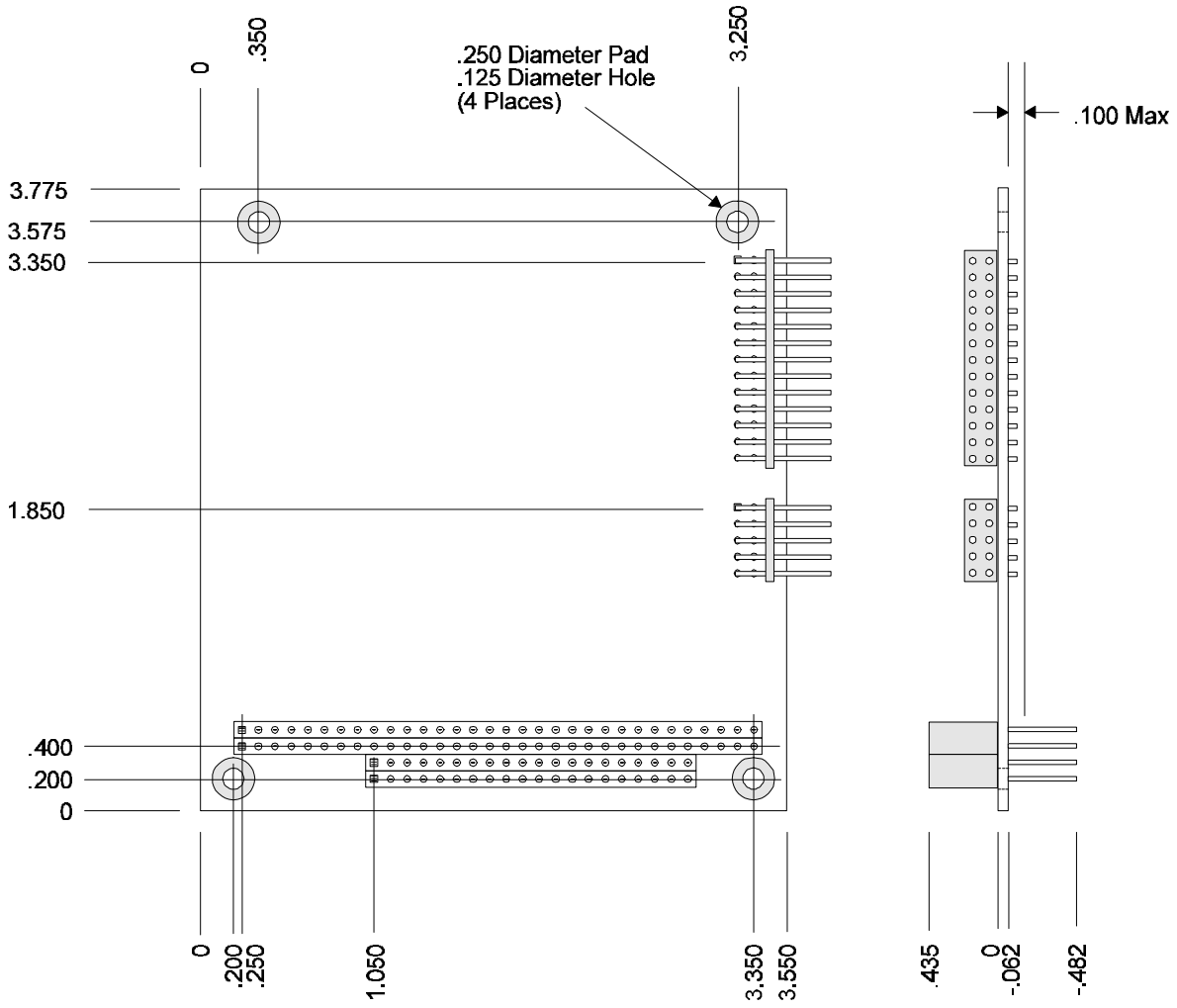

Figure 1-1 Mechanical Dimensions

CHAPTER 2

CONFIGURATION AND INSTALLATION

2.1 INTRODUCTION

This chapter provides information required to configure and install the MiniModule/SVG-II display controller in a system based on an Ampro CPU. This includes connecting cables and attaching the module to the Ampro CPU module. Since there are a minimal number of jumper settings and one interface cable, configuration is normally quite simple. When you complete these steps, your display controller is configured and ready to power up in the default VGA mode (730 X 400 Mode 3). If this is all you need to do, you may skip the rest of the manual. The information is organized as follows:

- **Setting the jumpers**—A discussion of how to set the configuration jumpers.
- **Selecting and cabling a monitor**—Information on interfacing Analog and TTL monitors.
- **Stacking the display controller with other Ampro modules**—Installation information for using the MiniModule/SVG-II in an Ampro CPU based system.

2.2 JUMPER SELECTIONS

There are four jumpers on the board, labeled W1, W2, W3, and W4. Table 2-1 summarizes how these jumpers are used.

Jumper	Description
W1	IRQ2 selection
W2, W3, and W4	16-bit/8-bit bus selection

Table 2-1 Jumper Summary

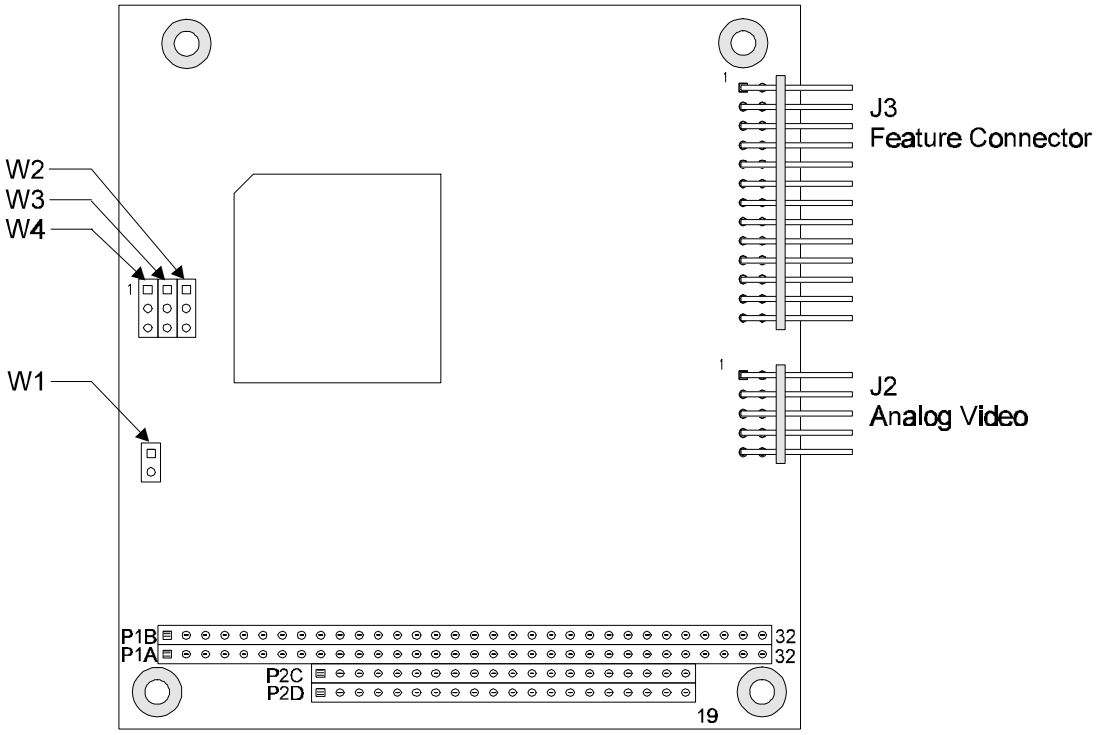

Figure 2-1 Connector and Jumper Locations

2.2.1 IRQ2 Jumpering (W1)

If your application needs interrupt IRQ2, short W1 with a jumper. Programs rarely require this interrupt enabled, so the default is disabled (no jumper installed), as shown in Figure 2-1. When it is not enabled, IRQ2 is available to other system devices.

2.2.2 16-bit/8-bit Bus Selection (W2-W4)

Jumpers W2, W3, and W4 are used to select whether the MiniModule/SVG-II will be used on an 8-bit bus or a 16-bit bus. W2, W3, and W4 are three-pin jumpers. The diagrams in Figure 2-2 illustrate how to set the jumpers for each configuration.

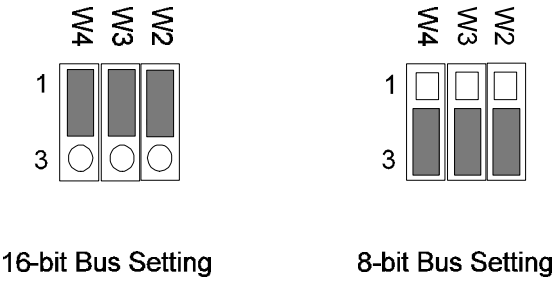

Figure 2-2 16-bit/8-bit Bus Selection Jumpering

2.3 ANALOG MONITOR INTERFACING (J2)

The MiniModule/SVG-II supports analog monitors for display. Table 1-3 and Table 1-4 in Chapter 1 provide cross references between video display modes and the timing specifications of popular monitors. Use these charts to select an appropriate monitor for your application. (Use of EL panels is discussed in Chapter 3, Using the Feature Connector.)

CAUTION

Because the MiniModule/SVG-II powers up in VGA mode, use *ONLY* a monitor that supports VGA mode as a minimum. During operation, never switch to a mode that the monitor cannot support or the monitor may be damaged.

Analog monitors use the 10-wire analog CRT transition cable, terminated in a female DB15 connector. This cable is included in the MiniModule/SVG-II Development Kit. If you are using this type of monitor, plug the cable's header connector into J2, and connect the monitor's cable to the DB15 connector. Table 2-2 shows the analog interface connector signal pinout and monitor cable wiring.

J2 Pins	Signal	DB15 Pin
1	Red	1
2	Ground	6
3	Green	2
4	Ground	7
5	Blue	3
6	Ground	8
7	Horizontal Sync	13
8	Ground	10
9	Vertical Sync	14
10	Ground	5

Table 2-2 Analog CRT Connector Signals (J2)

2.4 FEATURE CONNECTOR (J3)

The MiniModule/SVG-II provides a feature connector which presents all the standard IBM signals in the VESA standard pinout. You may use these signals with custom interfaces or with certain third-party products that use these signals. Chapter 3 describes more about the feature connector and about using it with third-party products (such as flat panel displays).

J3 Pin	Standard Connector Pin	Signal Description
2	Y1	Data Bit 0
4	Y2	Data Bit 1
6	Y3	Data Bit 2
8	Y4	Data Bit 3
10	Y5	Data Bit 4
12	Y6	Data Bit 5
14	Y7	Data Bit 6
16	Y8	Data Bit 7
18	Y9	DAC Clock
20	Y10	Blank
22	Y11	H Sync
24	Y12	V Sync
26	Y13	Ground
1	Z1	Ground
3	Z2	Ground
5	Z3	Ground
7	Z4	EVIDEO
9	Z5	ESYNC
11	Z6	EDCLK
13	Z7	n/c
15	Z8	Ground
17	Z9	Ground
19	Z10	Ground
21	Z11	Ground
23	Z12	n/c
25	Z13	n/c (key)

Table 2-3 Feature Connector Pinout (J3)

2.5 MODULE INSTALLATION

The MiniModule/SVG-II can be used in a variety of system configurations.

- It can be a part of a CoreModule™/MiniModule stack.
- It can plug onto an Ampro CoreModule or Little Board™ CPU.
- It can plug onto an Ampro accessory board.
- It can plug onto a custom carrier board.

The module is supplied with connectors compliant with the PC/104 specification. It is designed to plug to either a male or female header on any PC/104-compliant device.

To install the display controller:

- Either plug the pins of the module's bus header connector into the matching sockets of the bus header connector of the adjacent module or board, or plug the adjacent module's pins into the female bus header on the MiniModule/SVG-II. Be sure to mate the module's bus header correctly when you install it, or damage may occur when the unit is powered up.
- Use the spacers and associated hardware provided with the module to secure it to the parent board.
- Connect a monitor to the module, using an appropriate cable as discussed in the previous section.
- Once all attachments are secure, turn on the system power. The module will come up in standard VGA mode 03.

Refer to Chapter 3, Section 3-2 for information about initialization issues. These include the video type parameter that must be set on the CPU board, shadowing the video-BIOS for increased performance, and using the CLMODE utility to change the video mode and set the monitor timing.

CHAPTER 3

OPERATION

3.1 INTRODUCTION

This chapter discusses normal operation of the MiniModule/SVG-II, then describes using the display controller in resolution modes other than standard VGA. It also describes the various ways you can program the controller. It explains how to use the power management features. It concludes with a description of some of the uses for the feature connector.

3.2 INITIALIZATION

The MiniModule/SVG-II provides all standard VGA functions. Your software should work properly with all standard modes. The module also has enhancements to operate in "Super" VGA modes in the same manner as normal ones. All standard video-BIOS functions apply.

There is a "video type" parameter that must be set on the CPU. If it is not set to EGA/VGA, an error message will be displayed during the CPU's power-on self test (POST). If this is the case, invoke the CPU's SETUP function. (Consult the CPU's technical manual for details about the SETUP function.) Use SETUP to set the video type to “EGA/VGA.” Use this setting even if you intend to use the display module in CGA or monochrome modes.

On most Ampro CPU modules, you can choose to use DRAM to "shadow" the video-BIOS. Shadowing the video-BIOS means that the contents of the video-BIOS PROM are copied into faster DRAM memory and executed from there, increasing the display speed. This increase of speed will be noticed in applications where the video-BIOS is used frequently. Consult your CPU technical manual to see if video-BIOS shadowing is available, and how to enable it in SETUP.

Upon power-up, the module will attempt to come up in standard VGA mode 03. You can change the display mode from the DOS command line using the CLMODE utility, provided on the utility diskette that comes with the MiniModule/SVG-II Development Kit. Its use is described in the following section.

3.3 SOFTWARE CONTROL OF THE DISPLAY

The MiniModule/SVG-II allows you to switch modes with your software application. This feature permits great flexibility, particularly in embedded applications.

The resolution you ultimately see on the screen is a function of the mode you select and the amount of RAM installed on the MiniModule/SVG-II.

There are a number ways to obtain various text and graphics modes and to operate or program the graphics capabilities of the MiniModule/SVG-II:

- Using the Ampro-supplied utility CLMODE.EXE.
- Using supplied drivers for 3rd party software.
- Using a graphics library or product.
- Using Video-BIOS functions.
- Programming the Cirrus CL-GD542x graphics chip directly.

3.3.1 Using the Ampro-Supplied Utility, CLMODE.EXE

The CLMODE.EXE utility allows the user to define the type of monitor attached to the MiniModule/SVG-II and to set video modes. CLMODE is a DOS command line-oriented utility. It is invoked from the DOS command line with the following command:

```
CLMODE
```

The main window presents a number of control "buttons". Each button represents a different option or menu. The underlined letter of a button name specifies the key combination for that item. To select a button item, hold down the ALT key and press the underlined letter key. Options require just the underlined letter. You may also use a mouse to select a control button. (If you will be using a mouse, be sure to install the mouse driver.)

The information in the main window displays the VGA controller chip type, the video-BIOS version number, and the amount of video memory present.

Choosing a Monitor Type

For the highest quality visual display for a given monitor, select the proper monitor type for the resolution you want. The monitor type also determines which video modes will be available to your system. It will also determine the vertical refresh rate timing sent to the display. Generally, the higher the refresh rate, the less flicker will be seen.

To choose a monitor type, select the **Monitor Type** button. The Monitor Type setup window will be displayed. The highlight will show the current monitor type. Use the cursor keys or the mouse to choose the type of monitor that you want.

Creating Custom Monitor Timings

Selecting **Advanced** from the Monitor Type setup window will enable you to enter custom monitor timings. Select the **Set Advanced** button. This brings up a dialog box with drop down menus for each available resolution. Select the desired refresh rate for each resolution you want to support. You may want to consult your monitor's technical manual to ascertain correct rates. When you have completed setting the refresh rates, select the **OK** button. To cancel the changes, select the **Cancel** button.

To test the new video timings, select the **Verify** button. The program will let you view each new video timing so that you can verify that they are compatible with your monitor. After each test screen is displayed, press **Enter** or click the left mouse button to see the next resolution. Press **ESC** or the right mouse button to exit to the monitor type setup menu. If a timing setting you made does not work, try a slower setting and then try verifying your choices again.

Once your are satisfied, save the changes. To save new monitor timing values, press the **Save** button. You will be asked if you wish to save the monitor type selection in your AUTOEXEC.BAT file. If you wish to have your system come up with the new settings, answer "yes".

Displaying the Available Video Modes

Select the **Video Mode** button. The Video Mode Preview window displays all the modes supported according to the monitor type selected and the amount of video memory present on the MiniModule/SVG-II. This list of video modes will tell you which are available in your current configuration for use with your application.

To see what different video modes look like on the monitor, select the **Preview** button. After each test screen is displayed, press **Enter** or the left mouse button to see the next video mode. Press **ESC** or the right mouse button to cancel previewing the video modes.

On-line Help

To view help, press the **Help** button. CLMODE provides help for the following items:

- Monitor type—Explains the different capabilities of each monitor type.
- Video modes—Defines the information given in the Video Mode window.
- Mouse—Explains how to use the mouse to make selections.
- Keyboard—Explains how to use the keyboard to make selections.
- About CLMODE—Displays the Cirrus Logic copyright message and the CLMODE version number.

Exiting CLMODE

To exit CLMODE, press **ALT** and **F4** simultaneously, or select the system button on the main window using the left mouse button. (The system button is the in the top left corner of the main window, shown as a dot.) You may also select the **Exit** button.

When you exit CLMODE, the current video mode, monitor type, and VGA refresh rate will be displayed.

Using CLMODE's Command Line Options

CLMODE can be commanded to select a mode number or resolution from the command line. This is especially useful when using CLMODE in an embedded system. You can invoke CLMODE with command line options from your AUTOEXEC.BAT file.

The command line options for CLMODE are:

```
CLMODE [[modenum][+ | * | -][m(type) | t6=x | t8=x | t1=x | t2=x][S]
```

where:

modenum	Video mode number
+	Selects 400 lines (default)
*	Selects 350 lines
-	Selects 200 line
type	Monitor type (Monitor types are given in Table 1-4.)
t6=x	t6 indicates 640 x 480 resolution x=0 means 60 Hz, x=1 means 72 Hz.
t8=x	t8 indicates 800 x 600 resolution x=0 means 56 Hz, x=1 means 60 Hz, X=2 means 72 Hz
t1=x	t1 indicates 1024 x 768 resolution x=0 means 87 Hz, interlaced, x=1 means 60 Hz, x=2 means 70 Hz, x=3 means 72 Hz.
S	Settings: entering **S** as a command line option will display the current CLMODE settings.

Entering an invalid parameter will display help text.

Examples:

- To select mode 3 for a Super VGA monitor (montype 2), type the following command at the DOS prompt:

  ```
  CLMODE 3+ m2
  ```

- To select custom monitor timings with 640 x 480 at 60 Hz and 800 x 600 at 72 Hz, enter:

  ```
  CLMODE t6=0 t8=2
  ```

3.3.2 Using Supplied Drivers for 3rd Party Software

Video drivers are available for a number of popular applications, including AutoCad, Ventura Publisher, Lotus 123, and MS Word for DOS. Embedded systems rarely use these 3rd party applications, so the drivers will not be covered in detail here, and are not included on the Utility Diskette that is supplied with the MiniModule/SVG-II Development Kit. The files that are included on the diskette change from time to time, so a detailed list is not given here. In general, however, the drivers for Microsoft Windows 3.1 are supplied. The OS/2 Warp operating system includes drivers for the CL-GD542X. Contact Ampro Technical Support for information about 3rd party drivers for the MiniModule/SVG-II.

Run INSTALL.EXE from the Utility Diskette to install the Windows drivers and the SetRES utility. You can also install drivers individually using the Windows Setup program. Once installed, use the SetRES utility to select the Windows driver for the resolution you want. It is easier to use than the standard Windows Setup program.

3.3.3 Using a Graphics Library or Product

Another way to change resolution modes is to use third-party products for VGA and Super VGA. Third party software often includes source code OEMs can modify and use in their own applications. These programs often perform many complex functions besides simple mode changes.

The following graphic libraries may be used with the MiniModule/SVG-II when using resolutions up to 1024 X 768 with 16 colors. They are compatible with Borland's *Turbo C* and *Turbo Pascal*, and with Microsoft's *Microsoft C* and *Microsoft Pascal*. These four popular languages also have substantial graphic support software included in their packages.

> *Essential Graphics, Version 4.0*, South Mountain Software. 201-762-6965
>
> *GX Graphics, PCX Programmer's Toolkit, PCX Effect*, GENUS Microprogramming. 713-870-0737
>
> *HALO Professional*, Media Cybernetics. 800-992-4256
>
> *MetaWINDOW/PLUS*, Metagraphics. 408-438-1550

You may find these two software product catalog/buyer's guides especially helpful in locating additional graphic libraries and products.

The Connection, published quarterly by Programmer's Connection Inc.,
7249 Whipple Ave., NW, North Canton, Ohio 44720-7143. 800-336-1166.

The Programmer's Shop, published quarterly by SDC Communications,
90 Industrial Park, Hingham, MA 02043. 800-447-8041.

3.3.4 Using Video-BIOS Functions

To program the graphics controller, you may use the built-in high level functions in the video BIOS. Using this programming interface, you can control resolution modes, and a number of other functions and characteristics. All calls are made through software interrupt 10h (INT 10H). When you make the call, the contents of the AH register in the graphics controller chip determine the primary function; the contents of the AL register determine the secondary function.

Table 3-1 is an overview of the interrupt 10 functions for register AH.

AH Content	Function
00	Mode Set
01	Set cursor type
02	Set cursor position
03	Read cursor position
04	Read light pen position (not supported)
05	Select active display page
06	Scroll active page up
07	Scroll active page down
08	Read character at current cursor position
09	Write characters at current cursor position
0A	Write characters only at current cursor position
0B	Set color palette
0C	Write dot
0D	Read dot
0E	Write teletypewriter to active page
0F	Return current video state
10	Set palette registers
11	Character generator routine
12	Alternate select
13	Write string
1A	Display combination code
1B	Return functionality/state information
1C	Save/restore
14-19	Reserved

Table 3-1 Video-BIOS Function Calls to INT 10, Register AH

3.4 PROGRAMMING THE CIRRUS CL-GD542X GRAPHICS CHIP DIRECTLY

Some applications may require the fine control gained by direct chip programming. This section contains a memory map of the MiniModule/SVG-II and the I/O addresses you will need to do this type of programming. You will need to consult the Cirrus Logic CL-GD542x Technical Reference Manual (available from Cirrus Logic) as well as one or more of the sources of information that are given in the next section.

3.4.1 Memory Map

Table 3-2 provides a typical system memory map for an embedded PC system that uses a VGA video controller.

Memory Address	Function
F0000-FFFFFh	Ampro ROM-BIOS
D0000-EFFFFh	SSD Sockets and expansion boards
C0000-C7FFFh	Video BIOS
A0000-BFFFFh	Video Screen RAM
00000-9FFFFh	640K bytes onboard DRAM for programs

Table 3-2 Typical System Memory Map

3.4.2 I/O Port Map

Table 3-3 lists the I/O port addresses used on the MiniModule/SVG-II display controller. These are the same I/O addresses used by all PC-compatible standard VGA adapters. The table lists the addresses of the six sets of register types. If you need detailed information about emulation modes dependency, DAC converters, VGA chip registers, accessing registers for programming, or other topics, consult the Cirrus Logic CL-GD542x Technical Reference Manual.

Function	I/O Port Address (hex)
General Registers	3BA or 3DA, 3CA, 3C2, 3CC
Reserved Registers	3C6 to 3C9
Sequencer Registers	3C4 and 3C5
CRTC Registers	3B4 to 3B5 or 3D4 to 3D5
Graphics Registers	3CE to 3CF
Attribute Registers	3C0 to 3C1
VGA Master Control	46E8/2E8*
* See note in text.	

Table 3-3 I/O Port Addresses

NOTE

Peripheral adapters that use address 2E8h will be in conflict with the address of the MiniModule/SVG-II display controller. This includes a popular address for COM4 serial ports, as well as a commonly used address for Arcnet LAN adapters. This is because the IBM VGA standard uses a 16-bit field for this particular I/O address, whereas most I/O devices only decode 10 bits. When the 16-bit address (46E8h) is truncated to 10 bits, it is decoded as 2E8h.

3.5 USING THE POWER MANAGEMENT FEATURES

The MiniModule/SVG-II's graphics controller chip, the Cirrus Logic CL-GD542x provides features that implement a comprehensive set of power management controls that can be used to sharply reduce power consumption of the board and monitor during periods of inactivity. These features can be used to meet the U.S. EPA's Energy Star power management standards.

This section describes methods that can be used with the MiniModule/SVG-II to reduce power consumption. Some of the methods involve programming registers in the CL-GD542x controller chip. Note that if your application program does reprogram controller chip registers, the following considerations apply:

- It must first save the register contents so that it can subsequently restore them.
- It may be necessary to unlock the extended registers.

The greatest power savings can be obtained by placing the attached display monitor into a low-power mode. A monitor compliant with the Display Power Management Signaling (DPMS) standard is required to take advantage of this type of power reduction. The VESA (Video Electronics Standards Association) DPMS standard defines four levels of display power, as shown in the following table:

Name	Definition	HSYNC	VSYNC	Note
On	Full operation	Active	Active	
Stand by	Minimal power reduction	Inactive	Active	
Suspend	Significant power reduction	Active	Inactive	
Off	Maximum power reduction	Inactive	Inactive	

3.5.1 Video-BIOS Functions for Power Management

Power management modes are set by calls to video-BIOS extensions. The MiniModule/SVG-II video-BIOS is compliant with the VESA Display Power Management BIOS Extensions, VBE/PM. These video-BIOS calls are described in this section.

There are 3 video-BIOS calls that can be used to control the power-saving modes:

- Report VBE/PM Capabilities
- Set Display Power State
- Get Display Power State

Report VBE/PM Capabilities

Input:	AH = 4Fh	VESA extension
	AL = 10h	VBE/PM services
	BL = 00h	Report VBE/PM capabilities
	ES:DI	NULL pointer, must be 0000:0000h. (Reserved for future use.)
Output:	AX	Status
	BH	Power saving state signals supported by the controller (Note 1)
		1 = supported, 0 = not supported
		Bit 0 Stand by (not supported)
		Bit 1 Suspend
		Bit 2 Off
		Bit 3 Reduced on (intended for flat panel displays)

Note 1: The attached monitor may not support all the power states that can be signaled by the controller. It is the responsibility of the power-management program to determine which power-saving states are available. The MiniModule/SVG-II supports **Suspend** and **Off**.

Set Display Power State

Input:	AH = 4Fh	VESA extension
	AL = 10h	VBE/PM services
	BL = 01h	Set display power state
	BH =	Requested power state:
		00h On
		01h Stand by (not supported)
		02h Suspend
		04h Off
		08h Reduced on (intended for flat panel displays)
Output:	AX	Status: If the requested state is not available, this function will return AX = 14h to indicate that the call failed.
	BH	Unchanged

Get Display Power State

Input:	AH = 4Fh	VESA extension	
	AL = 10h	VBE/PM services	
	BL = 02h	Get display power state	
Output:	AX	Status: If this function is not supported by the controller hardware, AL = 01 is returned.	
	BH	Returns the current power state:	
		00h	On
		01h	Stand by (not supported)
		02h	Suspend
		04h	Off
		08h	Reduced on (intended for flat panel displays)

3.5.2 Power Management Hardware Bits

This section documents hardware bits in the video controller chip that can be set directly from application programs to control the power consumption of the MiniModule/SVG-II. Implementation details for using these internal hardware register bits are beyond the scope of this manual. Details about how to use these features can be found in the Cirrus Logic CL-GD542x Technical Reference Manual.

DAC Power-Down

The DAC can be put into a power-down state by programming the Hidden DAC register to C7h.

Video Clock/Display Memory Refresh

The video clock can be reduced to as low as 3.46 MHz and the DRAM refresh can be reduced to 5 cycles every 4.6 uS without losing the contents of display memory. This reduces the power in the display memory array and also reduces the power in the controller chip.

Memory Clock

The memory clock, MCLK, can be reduced to as low as 7.14 MHz. This further reduces the power of the module.

3.6 USING THE FEATURE CONNECTOR

The MiniModule/SVG-II provides the standard IBM VGA feature connector signals at J3. You can use J3 to route an external TTL video source to an analog monitor connected at J2, or to drive certain flat panels. For more information on using the Feature Connector and its use for external video input, see the Cirrus Logic CL-GD542x Technical Reference Manual.

Table 2-3 gives the pinout for the feature connector. The signals are in the same order as a standard VESA feature connector found on some desktop PC expansion cards. Ampro does not offer a cable to support the feature connector.

To control the monitor with an external video source via the feature connector, you may need to block certain signals. Except for EVIDEO, EDCLK, and ESYNC, the signals are bi-directional.

EVIDEO, EDCLK, and ESYNC are input-only. When pulled low, these three signals tri-state (that is, set to a high impedance state) video data, pixel clock, and sync and blank signals generated on the MiniModule/SVG-II, allowing them to be driven by signals connected to the feature connector. This allows corresponding signals from the external source to drive an analog monitor connected at J2.

Various vendors' products use the feature connector signals as inputs or outputs. In particular, Planar Systems, Inc., of Beaverton, Oregon, makes electroluminescent (EL) flat panel displays that are compatible with the MiniModule/SVG-II feature connector. Such panels have VGA resolution of 640 X 400 or higher, up to 16 shades. A panel such as this can replace a monitor, or run in parallel with a monitor.

For further information, contact Planar Systems, Inc., 1400 Compton Dr., Beaverton, OR 97006. Phone (503) 690-1100; FAX (503) 645-7074

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